MARCO

LENSMETER

INSTRUCTION HANDBOOK

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MARCO LENSMETER INSTRUCTION HANDBOOK

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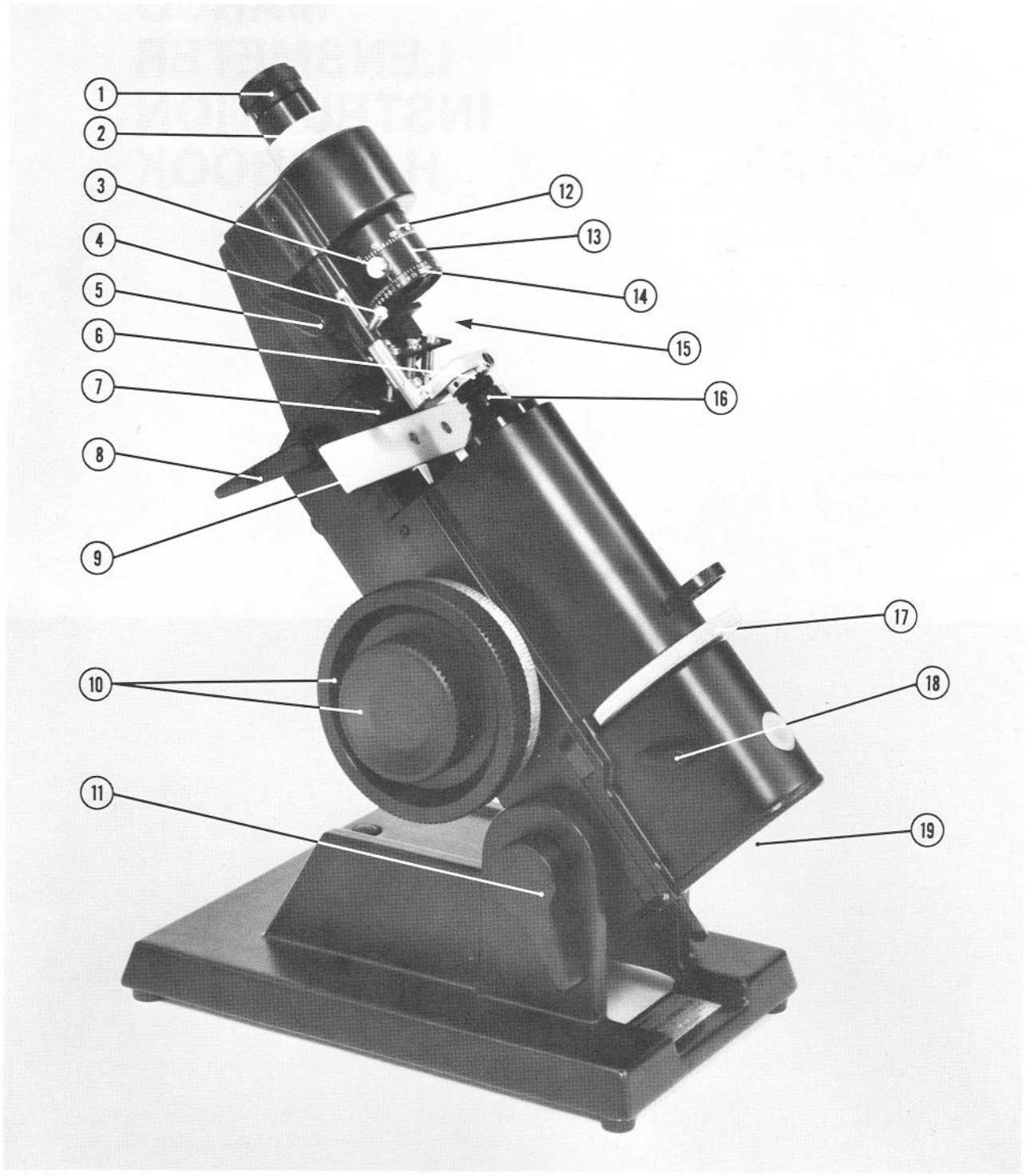

ILLUSTRATION I

1. Eyepiece
2. Chrome Knurled Sleeve
3. P.C.D. Knob
4. Lens Holder Handle
5. Marking Device Control
6. Gimbal
7. Ink Pad
8. Spectacle Table Lever
9. Spectacle Table
10. Power Drum
11. Locking Lever
12. Prism Axis Scale
13. P.C.D. (Prism Compensating Device)
14. Prism Diopter Power Scale
15. On-Off Switch (left side)
16. Lens Stop
17. Cylinder Axis Wheel
18. Filter Lever
19. Lamp Access Cover

INTRODUCTION

The measurement of lens power is a most important function in the handling of ophthalmic lenses, from fabrication to the final inspection of the completed prescription.

The Marco Lensmeter is the finest instrument available for factory, laboratory, and professional office use. It provides remarkable accuracy in measuring spherical, cylindrical and prism powers of a lens, as well as cylinder axis and the prism base-apex line.

Marking lenses for cutting and edging in the laboratory is facilitated with a precision marking device. The finished glasses can be easily and accurately checked for compliance with the written prescription. By means of the adjustable spectacle table, quick and accurate assessments can be made of optical centers, cylinder axis, P.D. and prismatic imbalances as well as bifocal heights.

The design and manufacturing quality of the Marco Lensmeter assure a long life and accurate interpretation of lenses wherever used. With its easy adjustments, it is adaptable to all personnel and all tasks.

The instrument is shipped completely assembled and ready for use. After removing the instrument from its shipping carton, place it on a bench or table in its intended place of use and plug the cord into a standard electrical receptacle (120 volts AC). Loosen the locking lever (Illus. I, No. 11) and tilt the Lensmeter to any angle, from horizontal to vertical, for comfortable viewing and tighten the lever. The instrument may be easily readjusted to the vertical position for contact lens measurement.

GENERAL DESCRIPTION

The Marco Lensmeter consists essentially of a centered optical system with a telescope aimed at a standard lens and a movable, rotatable target aligned with a light source. The instrument is designed to hold a spectacle lens at the anterior principle focus of the standard lens and for rotating and axially shifting the target behind the standard lens.

In use, the target is positioned and oriented so that it is imaged by the standard lens at the focus (or foci in a compound lens) of the lens being tested. The target is, therefore, imaged by the spectacle lens on the reticle of the telescope eyepiece, and is viewed through the eye lens.

THE EYEPIECE (Illus. I, No. 1): The telescope is composed of an eye lens; a reticle (Illus. II), rotatable and calibrated for prism evaluation, and an objective lens. The eye lens is mounted in a screw-type focusing mechanism with a range from + 5 diopters to – 5 diopters to compensate for different individual requirements. This lens adjustment permits critical focus on the reticle for each individual's needs.

The scale on the eyepiece is useful as a reference when different individuals use the same Lensmeter. However, one should not rely completely on setting the eyepiece by scale reading only. Periodically the reticle should be checked for critical focus. The eyepiece is made of material that will not scratch an observer's eyeglasses, though care should be used when wearing plastic lenses.

THE PRISM SCALE (Reticle): The chrome knurled sleeve (Illus. I, No. 2) can be rotated 180° and controls the reticle which is viewed through the eye lens. The reticle is engraved with a median cross-line and concentric circles calibrated to show prism of 0.50, 1.00, 2.00 and 3.00 diopters. The 4.00 and 5.00 prism diopter scales are along the median line only. The protractor is calibrated at 5° intervals from 0 to 180° and establishes the meridian of the base-apex line of the measured prism. Auxiliary prism power can be added by the use of the prism compensating device (Illus. I, No. 13) to extend the range of measurable prism to 20 diopters in any meridian.

PRISM COMPENSATING DEVICE (P.C.D.) (Illus. I, No. 13): The prism compensating device is used whenever a prism of more than 5 diopters is induced at the point of reference on the lens examined, such as in phoria corrections and/or segment decentration in bifocals of high power corrections. In these instances the target is displaced almost or completely out of the field. It can be brought back into the center of the field with the P.C.D.

Rotating the P.C.D. knob (Illus. I, No. 3) around its own axis changes the reading of the prism diopter power scale, (Illus. I, No. 14). Rotating this knob about the optical axis of the Lensmeter changes the base-apex line of the prism. See scale (Illus. I, No. 12). The red scale (0-15 prism diopters) (Illus. I, No. 14) signifies the base of the prism is "opposite" the base indicated on Scale No. 12. It is necessary, therefore, to add 180° to the reading indicated on Scale No. 12. The white scale signifies the prism base is as indicated on Scale No. 12.

LENS HOLDER: A nonscratch gimbal (Illus. I, No. 6) on

the end of a spring loaded arm serves to hold the lens against the lens stop (Illus. I, No. 16), which is also made of a nonscratch material. Both the gimbal and the lens stop should be kept free of dirt and dust as an additional precaution when working with plastic lenses. The handle (Illus. I, No. 4) provides for finger release and retraction of this arm by a simple 45° rotation.

MARKING DEVICE: The marking device, controlled by a lever (Illus. I, No. 5) provides a simple, accurate means of spotting the optical center of a lens (center pin) and its 180° line (3 pins).

STANDARD LENS: The standard lens is directly behind the lens stop in such a position that its anterior principle focus coincides with the lens stop. This adjustment is critical and has been made at the factory. No attempt should be made to move either the standard lens or the lens stop except by qualified service personnel.

SPECTACLE TABLE (Illus. I, No. 9): The spectacle table is moved up or down by a lever (Illus. I, No. 8). During its vertical movement, the lens table remains parallel to the 180° line of reference. This feature allows the accurate evaluation of mounted or unmounted spectacle lenses.

POWER DRUM (Illus. I, No. 10): The power drum scale is on the right side of the Lensmeter and has a large and small handwheel coaxial with the scale. There is also a small handwheel on the left side for bilateral operation. The scale reads from −20 diopters (red numerals) to +20 diopters (black numerals) in 0.25 diopter steps, except from −3.00 diopters to +3.00 diopters the steps are 0.125 diopters.

CYLINDER AXIS WHEEL (Illus. I, No. 17): The cylinder axis wheel is calibrated in 1° intervals from zero degrees to 180° and controls the rotation of the target for determination of cylinder axis.

LAMP ACCESS COVER (Illus. I, No. 19): To replace lamp, pull down lamp house cover (hinged at bottom), unscrew lamp and replace. Return cover to original position.

FILTER LEVER: The filter lever (Illus. I, No. 18) permits removal of the green filter from the optical path. In normal use—for clear and lightly tinted lenses—the green filter should be in place to permit more comfortable, as well as more accurate, reading of the target. When dark lenses are being checked, the filter should be swung away to allow more illumination for penetration of the deeper lens shades.

OPERATION OF THE MARCO LENSMETER

Place the Lensmeter in a suitable work space, positioned and tilted to provide the operator with a comfortable operating posture for looking into the eyepiece and manipulating the drums and control levers. It is unnecessary to have reduced illumination in the work area.

If the marking device is to be used, slide the ink pad (Illus. I, No. 7) out and apply stamp pad ink to the pad and replace. A slight upward motion of the marking lever (Illus. I, No. 5) will ink the marking pens, and a downward and forward motion will bring the pens into contact with the lens to be marked. Keep ink pad area clear of any excess ink by occasional wiping. Clean marking pens periodically to prevent ink buildup.

EYEPIECE FOCUS:

Focus of the eyepiece is the single most critical adjustment for the accurate use of the Lensmeter.

Each individual must adjust the eye lens for his eye as he would a telescope or a binocular. The adjustment is made as follows (be sure that the power drum reads zero):

1. Hold a piece of white paper at an angle between the lens stop and the prism compensating device so as to reflect light into the telescope. Look at the lines of the reticle (Illus. II). They should be sharply in focus.

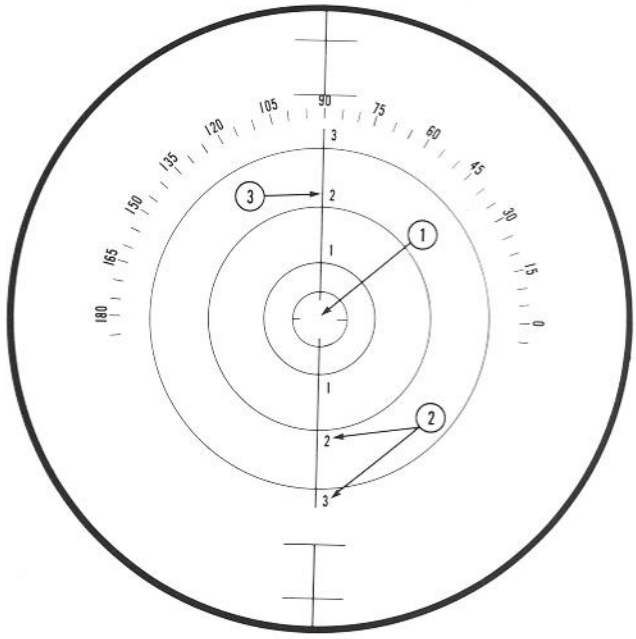

ILLUSTRATION II
RETICLE IN FOCUS

1. Center
2. Prism Diopter (Power Values)
3. Median Cross-Line

2. If they are not critically sharp, blur the lines by turning the eyepiece (Illus I, No. 1) counterclockwise, then turn clockwise slowly until the 1.0 prism diopter circle on the reticle is critically in focus. Do not bracket this focal point by turning the eye lens back and forth. Come to a critically sharp focus with a clockwise rotation and stop.

3. With the power drum (Illus. I, No. 10) set at −2 or −3 diopters (red scale), turn on the instrument light with the toggle switch (Illus. I, No. 15) on the left side of the instrument below the prism compensating device. Rotate the power drum toward zero (turn top of drum toward you), while looking in the eyepiece (telescope), until the target is sharply focused. The drum reading should be exactly zero. If not, repeat Step 2 above and recheck for zero reading of the drum being careful to always turn toward zero by moving the top of the drum toward you. This same precaution should be observed when taking any reading with the Lensmeter. Failing to heed this precaution can introduce both fatigue and erroneous readings.

4. If more than one person uses the Lensmeter, each should make a mental note of the scale reading on the eyepiece so that it can readily be set for later use.

LENS MEASUREMENT:

1. Place the back surface (concave/eye side) of the lens to be measured against the lens stop (Illus. I, No. 16) and release the lens holder (Illus. I, No. 4) gently to hold the lens. Front vertex can be read by merely placing the lens in the appropriate manner.
2. Move the lens up and down (with or without the spectacle table) and sideways until it is approximately centered over the lens stop. If the lens is mounted in a frame, be sure to use the spectacle table.
3. Look into the telescope and simultaneously rotate the power drum (Illus. I, No. 10) and the cylinder axis wheel (Illus. I, No. 17) until the bright line target (Illus. III and IV) appears sharply in focus. Make sure the last movement of the power drum is "topside" toward you.

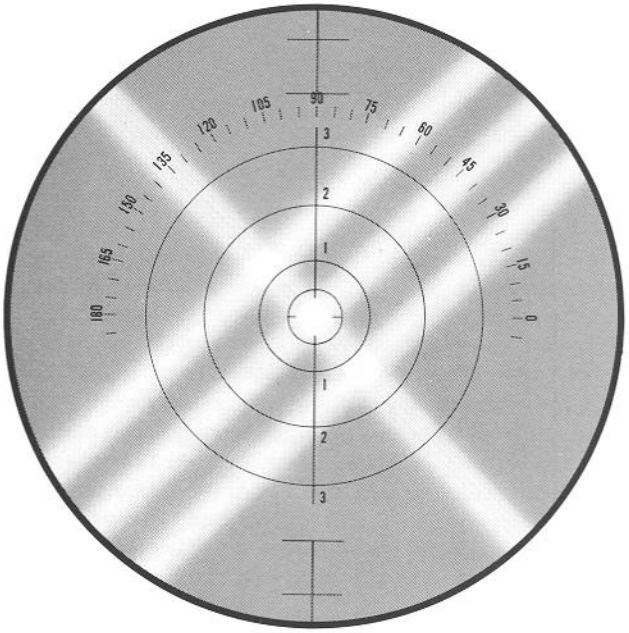

ILLUSTRATION III
TARGET OUT OF FOCUS

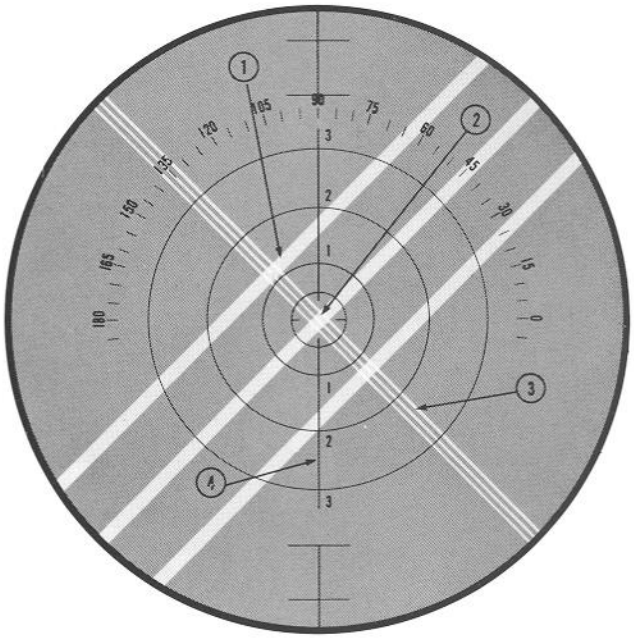

ILLUSTRATION IV
TARGET IN FOCUS

1. Cylinder Target
2. Center of Reticle and Target Center
3. Sphere Target
4. Reticle Median Cross-Line

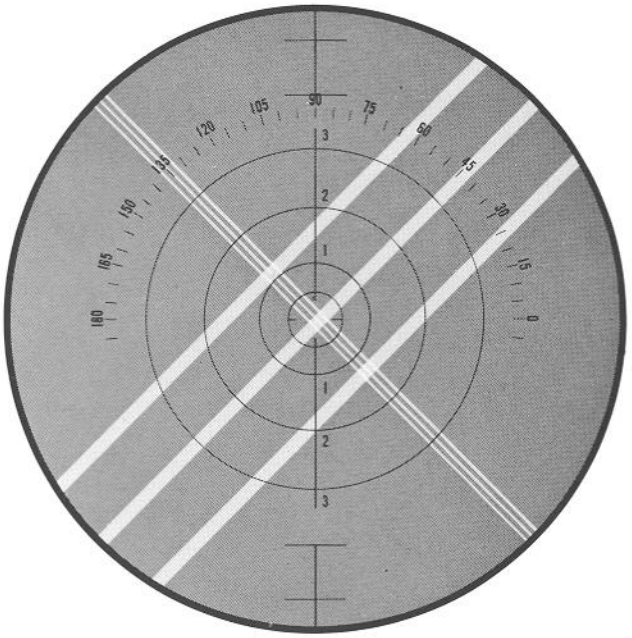

ILLUSTRATION V
SPHERE POWER ONLY

Sphere Target and Cylinder Target in Focus

If both the sphere target (triple narrow lines) and the cylinder target (three broad, widely spaced lines) are sharply focused at the same time, the lens has sphere power only (Illus. V). The sphere power can be read directly on the power drum opposite the fixed index. The red scale is minus power; the black scale is plus.

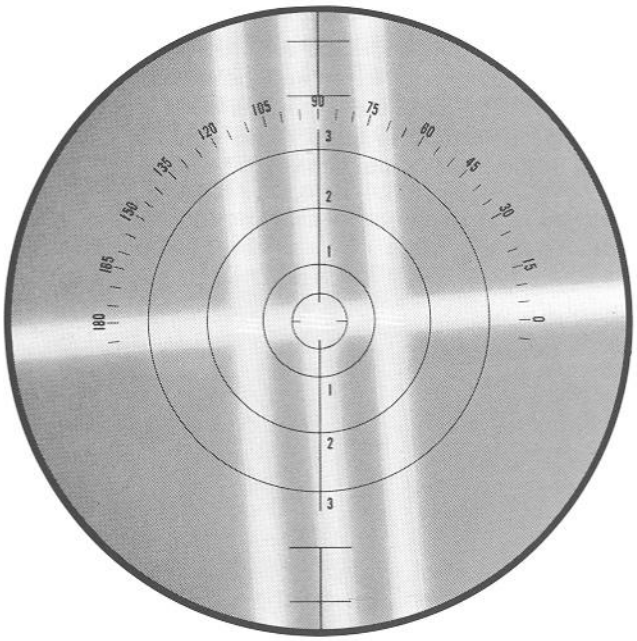

ILLUSTRATION VI
SPHERO CYLINDER LENS
Sphere Target Out of Focus

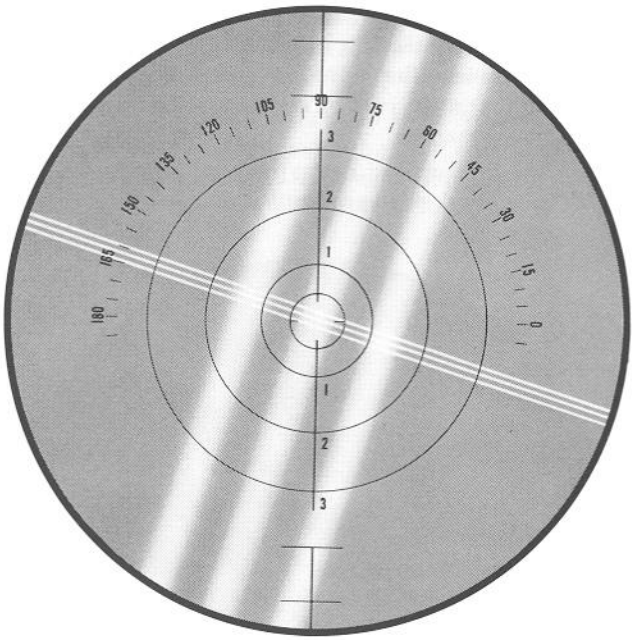

ILLUSTRATION VII
SPHERO CYLINDER LENS
Sphere Target in Focus

4. If only the sphere target (triple narrow lines) or the cylinder target comes into sharp focus, there is either plus or minus cylinder power in the lens (Illus. VI, VII, and VIII). By turning the power drum you will find a second position at which the other target lines will be in focus.
5. The cylinder power of a lens may be written and/or measured in either plus or minus cylinder form.
   a. To measure the cylinder in minus cylinder form, bring the sphere target (triple narrow lines) into sharp focus and with the cylinder axis wheel rotate the target slowly until the triple lines are continuous, sharply focused and without "feathered" edges. Rotate the power drum to determine in which direction it must be turned to bring the cylinder target (three broad lines) into focus. If you have to introduce a more minus (or less plus) reading, the target is properly oriented.
   b. If you have to rotate the power drum to a higher plus (less minus) reading to bring the three wide lines into focus, the target is oriented to read in plus cylinder form. Rotate the target (axis wheel) 90°, and refocus to be sure the sphere target is again continuous, sharply focused, and without feathered edges.
   c. The power drum reading is now the sphere power of the prescription and should be recorded. Move the power drum toward the more minus (less plus) until the cylinder target is in sharp focus and record the reading.

ILLUSTRATION VIII
SPHERO CYLINDER LENS
Cylinder Target in Focus

d. The difference between the two readings is the power of the cylinder; the axis of the cylinder is read directly from the cylinder axis wheel.

The following are examples:

	Prescription No.		
	1	2	3
1st Power Drum Reading	−2.75D	+3.00D	+0.75D
2nd Power Drum Reading	−4.75D	+1.50D	−0.75D
Direction Power Wheel Moves	-	-	-
Difference in Power Drum Reading	−2.00D	−1.50D	−1.50D
Axis Wheel Reading	145°	180°	75°
Prescription No. 1	−2.75	−2.00	×145°
2	+3.00	−1.50	×180°
3	+0.75	−1.50	× 75°

e. If you wish to read the prescription in plus cylinder form proceed as follows: Insert and center the lens over the lens stop. Turn power drum and cylinder axis wheel to bring sphere target into sharp focus as described for minus cylinders. Rotate the power drum until the cylinder target is in focus and determine in which direction you have had to go. If you added more plus power (less minus), the sphere target is in the proper meridian. If you "added" minus power, rotate the target 90° and focus critically again on the sphere target. Record this power which is the sphere power of the prescription. Now move the power drum to add more plus (less minus) until cylinder target is sharp. The difference between the first and second power drum readings is the power of the cylinder in plus cylinder form and its axis as indicated on the axis wheel.

f. Examples:

	Prescription No.		
	1	2	3
1st Power Drum Reading	−4.75D	+1.50D	−0.75D
2nd Power Drum Reading	−2.75D	+3.00D	+0.75D
Direction of Power Drum Movement	+	+	+
Difference in Power Drum Readings	+2.00D	+1.50D	+1.50D
Axis Wheel Reading	55°	90°	165°
Prescription No. 1	−4.75	+2.00	× 55°
2	+1.50	+1.50	× 90°
3	−0.75	+1.50	×165°

It may be of interest to note that in the foregoing examples we have used identical prescriptions merely exchanging the minus cylinder form of the first three for the plus cylinder form in the last three. It is obvious then that any prescription may be "transposed" (plus to minus or minus to plus form) in the Lensmeter, or one can use the following formula: To transpose a prescription, as written, to the opposite cylinder sign, algebraically add the sphere and cylinder powers to arrive at the new sphere power, change the sign of the cylinder (from plus to minus or minus to plus), and change the axis 90°, that is, +1.00 −2.00 × 90 = −1.00 +2.00 × 180°.

LENS CENTERING AND MARKING:

Clamp the lens against the lens stop and while looking into the eyepiece shift the lens until the center of the target is coincident with the center of the reticle of the eyepiece. Loosen the lens holder slightly during shifting to reduce the chance of scratching the lens.

Set the cylinder axis wheel (if cylinder is in the lens) at proper axis as called for in the prescription, and rotate lens until sphere target is sharp and clear. Check to make sure the cylinder power is plus or minus as required. See instructions above.

Clamp the lens, checking for centration, and mark with lens marker. The center dot will be the optical center and the line of the three dots will indicate the 180° or "mounting line" of the lens.

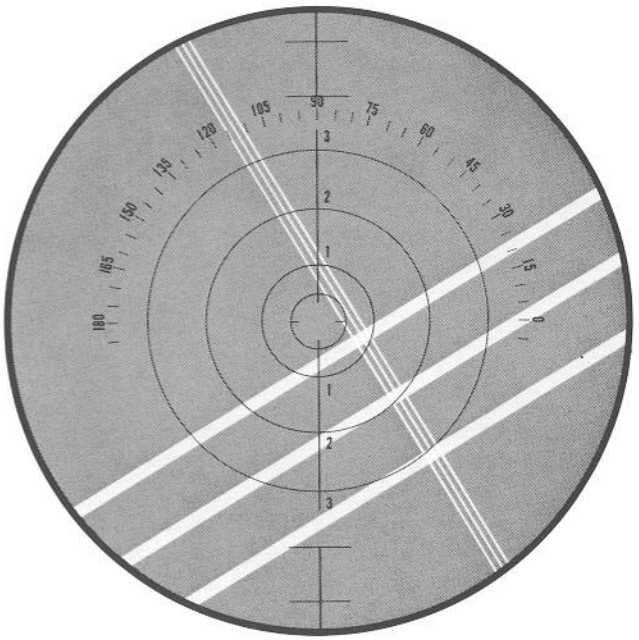

ILLUSTRATION IX
DECENTERED TARGET

PRISM MEASUREMENTS (Refer to Illus. IX and X):

1. Place a dot at the point on the lens at which you wish to measure the prismatic power. This is usually the point which you predetermine for pupillary distance.

2. Clamp the lens (back surface toward lens stop) in the Lensmeter with the above dot centered in the lens stop and the 180° line (mounting line) coincident with the tip of the axis marker pins. This is done with the axis marking device. If the lenses are in a frame, set the frame on the spectacle table to align the 180° line properly.

3. Bring the target into focus as previously explained. It will now be decentered due to the amount of prism induced. This displacement (decentration) will always be in the direction of the base of the induced prism. That is, it will be displaced up for prism base up; down for prism base down. It will be displaced right for prism base "in" for the right eye; "out" for left eye. It will be displaced left for prism base "out" in the right eye; "in" for the left eye.

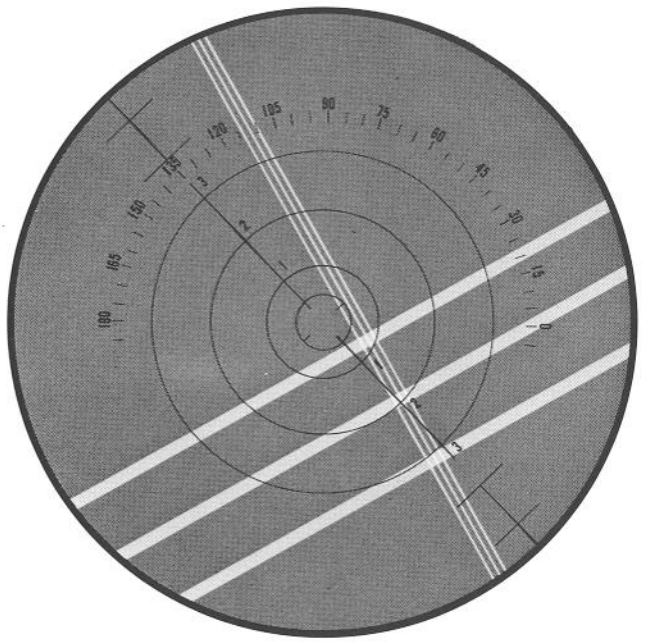

ILLUSTRATION X
MEDIAN CROSS-LINE INTERSECTING TARGET CENTER

Read: 2.00 Base Down and "In" for Right Eye, "Out" for Left Eye

4. Rotate the reticle (prism scale) with chrome sleeve (Illus. I, No. 2), until the median cross-line bisects the center of the target.
5. The amount of prism power induced is indicated by the displacement of the target center and is measured by referring to the concentric circles on the reticle. Power of up to five prism diopters is indicated by the numbered rings, and quarter diopter prisms can be readily estimated. In the event of stronger prisms (more than five prism diopters), you can use the prism compensating device (P.C.D.) for up to 20 prism diopters in any meridian. You can also use the device for centering the target with any amount of prism (up to 15 prism diopters) so as to make readings more accurate. See the instructions for the use of the prism compensating device, which follow.

PRISM COMPENSATING DEVICE:

CAUTION: Whenever the prism compensating device is not in use, be sure the Risley prism is set at zero (Illus. I, No. 14) and the axis is set at 180° (so control knob No. 3 is out of the way). This zero reading should be checked frequently to avoid any accidental decentration of lenses.

1. Place the lens under consideration against the lens stop so that the point of reference on the lens is centered in the center of the lens stop (on the Lensmeter optical axis) and the 180° line coincides with the three marking pins (center pin at point of reference).
2. Set the power drum to the sphere power of the prescription. If there are more than five prism diopters at this point the target must be brought back into the field with the prism compensating device. Rotate knob No. 3 to bring the center of the target to coincide with the center of the reticle. Rotating the knob about its own axis changes prism power. Rotating this knob about the Lensmeter optical axis changes the base direction.
3. Rotate the power drum when necessary (in cylinder prescriptions) to focus the cylinder target and rotate the P.C.D. knob until target is exactly centered in the reticle crosshair. The prism power and base direction are read directly from scales No. 14 and 12, respectively, except that if scale No. 14 is red, add 180° to scale No. 12 reading for base meridian.
4. In the event the prism to be measured is between 15 and 20 prism diopters, set the P.C.D. to the 15 prism diopter scale and rotate about the Lensmeter optical axis until the target comes into the field. Continue this rotation until the target is at the nearest point to the reticle center. Focus the target as described above. The actual prism power will be the prism reading (on the reticle) plus 15 prism diopters, and the base meridian must be read from scale No. 12.
5. The P.C.D. can be of extreme importance in evaluating bifocal additions where the prescription is such that it moves the target either to the edge or out of the field when the bifocal add is placed in the Lensmeter at the proper reading level. The P.C.D. can, in such cases, bring the target back to the center of the field for accurate reading.

MEASURING BIFOCAL ADDITIONS:

The "true" value of the addition of a bifocal is the difference between the distance power of the lens and the power reading through the reading segment, with the segment surface against the lens stop for both readings. That is, for fused bifocals and other "front surface" adds, the front (convex) surface of the lens should be placed against the lens stop; for ultex type lenses and "back surface" adds, the back (concave) surface should be placed against the lens stop.

To measure the true power of addition:

a. Place segment surface of lens against the lens stop.
b. Measure the sphere power through the distance portion of the lens.
c. Move the lens to bring the segment into position on the lens stop and read the sphere power.
d. The true value of the addition is the difference between readings "b" and "c".

In many cases the target viewed through the segment will be blurred or even out of the field. See instructions above for the use of P.C.D. to bring target into the center field.

A compromise method of reading bifocal additions is to read the distance prescription with the back surface of the lens against the lens stop (see instructions for reading prescription) and then to move the lens so as to take a reading through the segment. In low power prescriptions, this approximation is satisfactory; but if there is any doubt, use the first method described.

MEASURING VERTICAL IMBALANCE OF THE LENS AT READING LEVEL:

1. Mark the lenses at the normal reading level and at proper reading.

2. Clamp the lens of "stronger" (absolute) power (either plus or minus) in the Lensmeter and center the mark in the lens stop.
3. Bring the target into focus and note the amount and direction (up or down) of the induced prism. (Disregard any lateral prism induced at this point.)
4. Repeat steps 2 and 3 above for the weaker lens.
5. If the induced prism in each lens is in the same direction (up or down), the imbalance is the difference between the two values. If the induced prism is up in one lens, down in the other, the imbalance is the sum of the two values.

LAYOUT OF LENSES FOR EDGING:

In the laboratory the Lensmeter not only checks the accuracy of lenses against the prescription but, at the same time, permits marking the uncut lenses for edging as follows:

1. Dot the segment center (if a bifocal), and clamp lens in Lensmeter.
2. Set the power drum at sphere power of prescription and cylinder axis wheel at the prescription axis (if cylinder power is prescribed).
3. Rotate the lens until sphere target (three fine lines) is sharp and unbroken.
4. Shift lens until sphere target is centered in the reticle. If prism is required, decenter sphere target according to the prescription.
5. Rotate the power drum to bring cylinder target (three wide lines) into focus and shift lens as necessary to bring target into center reticle. Check cylinder power and refocus power sphere target to make sure the power and centering are correct.
6. With the lensmarker, dot the 180° line.
7. For single vision lenses, the edging line can be drawn using the three dots for reference.
8. If there is any decentration required in satisfying the prescription, the "edging center" must be relocated accordingly.
9. For bifocal lenses, use a protractor and place the three dots "on line" and check for segment location. Then draw edging line as in No. 7.

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A division of **Marco Ophthalmic, Inc.**
11825 Central Parkway, P. O. Box 16938
Jacksonville, FL 32245-6938
(904) 642-9330; Fax: (904) 642-9338
US/Canada Toll-free: 1(800) 874-5274
http://www.marco.org

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